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THE COMMUNITY OF STRONGYLIDS (NEMATODA, STRONGYLIDA) OF WORKING DONKEYS (*EQUUS ASINUS*) IN UKRAINE

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The Community of Strongylids (Nematoda, Strongylida) of Working Donkeys (*Equus asinus*) in Ukraine. Kuzmina T. A., Kuzmin Yu. I. — The aim of our work was to study the species composition of the strongylid community of donkeys and to explore the influence of anthelmintic treatments on the community structure. Strongylid nematodes were collected by the diagnostic deworming technique from 33 donkeys from the riding school "Chudo-oslik" (Crimea) (25), from Kharkiv (3) and Kyiv zoos (2) and Kyiv riding schools (3). Seventeen species were found in donkeys studied: 16 species of Cyathostominae and 1 of Strongylinae. Between 2 and 7 species were found per donkey (average of 4.2 ± 2.8). *Cyathostomum tetracanthum, C. catinatum, Cylicocyclus nassatus, Cylicostephanus goldi* and *C. longibursatus*) dominated in the community; they were found in 80—100% animals studied and comprised 91.7% of the total number of strongylids collected. Two species *C. tetracanthum* and *Cylicocyclus auriculatus* were found to be specific for donkeys. The results obtained showed a reduction of the species richness of the strongylid community in donkeys from riding schools and zoos caused by lack of grazing and by regular anthelmintic treatments.

Key words: Strongylida, Cyathostominae, donkey, *Equus asinus*, Ukraine.

Сообщество стронгилид кишечника ослов (*Equus asinus*) в Украине. Кузьмина Т. А., Кузьмин Ю. И. — Целью нашей работы было изучение видового состава стронгилид кишечника домашних ослов и исследование влияния дегельминтизаций на структуру сообщества стронгилид. Прижизненным методом диагностической дегельминтизации собраны стронгилиды от 33 ослов из частной крымской фермы «Чудо-ослик» (25), Харьковского (3) и Киевского зоопарков (2) и школ верховой езды г. Киева (3). Обнаружено 17 видов стронгилид: 16 видов подсемейства Cyathostominae и 1 — Strongylinae. У одного животного паразитировало от 2 до 7 видов стронгилид (в среднем 4,2 ± 2,8). В сообществе стронгилид доминировали 5 видов (*Cyathostomum tetracanthum, C. catinatum, Cylicocyclus nassatus, Cylicostephanus goldi* и *C. longibursatus*); они обнаруживали у 80—100% ослов и в сумме они составляли 91,7% количества собранных стронгилид. Два вида — *C. tetracanthum* и *Cylicocyclus auriculatus* — являлись типичными для ослов. Полученные результаты указывают на снижение видового разнообразия сообщества стронгилид ослов из зоопарков и школ верховой езды, обусловленное отсутствием пастбища и регулярным проведением дегельминтизаций.

Ключевые слова: Strongylida, Cyathostominae, осел, *Equus asinus*, Украина.

Introduction

Donkeys (*Equus asinus* Linnaeus) are the main beasts of burden in many regions of the world, particularly in Africa, Asia, South and Latin America. It is believed that about 44 millions of donkeys are kept worldwide, mainly as working animals (Starkey, Starkey, 2000). In Ukraine, donkeys also have been the beasts of burden for hundreds of years. Nowadays, they are kept mainly as pets in zoos, circuses, riding schools and natural reserves. However, in southern regions of Ukraine (Odesa, Kherson and Mykolayiv Regions) donkeys are still used as working animals. The total number of donkeys kept in Ukraine is approximetely 3—5,000. This makes impossible to euthanize sufficient amount of donkeys for *post mortem* parasitological investigation.

Parasites of donkeys are well studied in the regions where they are widely used as beasts of burden: in Mexico (Aluja et al., 1990), Brazil (Oliviera et al., 1994), Turkey (Burgu et al., 1995), Sudan (Kheir et al.,

1981), Morocco (Cabaret, Pandey, 1980), Zimbabwe (Eysker, Pandey, 1989), Kenia (Ngatia, Kuria, 1991), South Africa (Matthee et al., 2000, 2002; Wells et al., 1998), Burkina Faso (Vercruysse et al., 1986), Uzbekistan (Matchanov et al., 1981; Sultanov et al., 1976), Turkmenia (Dobrynin, 1978), Italy (Ricci, Sabatini, 1992), Greece (Sotiraki et al., 1997). In Ukraine, intestinal parasites of donkeys have not been thoroughly investigated yet. Six donkeys kept under semi-free conditions at "Askania-Nova" Biosphere Reserve were first studied by the diagnostic deworming method (Kuzmina et al., 2007 a). However, there was no data about the strongylid community structure of domestic donkeys from zoos and riding schools; there donkeys are kept mainly in stables and regularly dewormed with various anthelmintics.

The aim of our work was to study the species composition of the gastrointestinal strongylids of domestic donkeys by *in vivo* method and to explore the influence of anthelmintic treatments on the strongylid community structure. We also compared strongylid community of donkeys from Ukraine with those from other parts of the world.

Material and methods

Thirty-three donkeys were involved into the study, including 25 animals from the private riding school "Chudo-oslik" (Crimea), 3 from Kharkiv Zoo, 2 from Kyiv Zoo and 3 from Kyiv riding schools. The donkeys were kept in stables without grazing and were treated by various anthelmintics twice per year. All animals were not dewormed at least 4 month prior to the study.

Faecal egg counts were performed a day before treatment and five days after treatment using the McMaster method (Herd, 1992). All donkeys were treated with aversectin drugs "Univerm" (0.2% aversectin, Russia) or "Nemasectin" (0.2% aversectin, Ukraine). Faecal sampling (100 g each) was performed 24, 36 and 48 hours after treatment; all strongylids expelled were collected and identified by morphological criteria (Dvojnos, Kharchenko, 1994).

Four domestic horses, which were kept with donkeys at the riding schools (one horse was from the "Chudo-oslik" farm and three – from Kyiv riding schools) were dewormed simultaneously with donkeys to compare the parasite communities of donkeys and horses kept together.

Results

Strongylid community structure in donkeys from Ukraine

All donkeys examined were infected with strongylids; the average infection level was 75 EPG (25—200 EPG). On the 5th day after treatment, no strongylid eggs were found in faeces. Totally 1560 nematodes were collected and identified.

Seventeen strongylid species of 5 genera were found in the donkeys examined (fig. 1): 16 species of Cyathostominae and 1 of Strongylinae. From 2 to 7 species were found in each host (average of 4.2 ± 2.8 S. D.). Five species (*Cyathostomum tetracanthum, C. catinatum, Cylicocyclus nassatus, Cylicostephanus goldi* and *C. longibursatus*) dominated in the strongylid community; they were found in 80—100% of animals and composed 91.7% of the total number of strongylids collected.

According to prevalence values, all strongylid species (17) were ranged in 10 prevalence classes (0—10%, ..., 91—100%). The number of taxa corresponding to each prevalence class was determined (fig. 2). The shape of the prevalence frequency distribution of the strongylid species appeared to be bimodal, with clear "core – satellite" mode.

Fourteen strongylid species were found in four horses examined; all species were shared with donkeys. *S. edentatus*, *C. tetracanthum* and *Cylicocyclus auriculatus* were not found in the horses. *C. auriculatus*, a specific parasite of donkeys, was first registered in Ukraine.

Comparison of strongylid communities from donkeys in Ukraine and other countries

Fifty-three strongylid species are reported from donkeys worldwide. All of them have cosmopolitan distribution. The number of species found in donkeys from separate parts of the world varies from 12 up to 29 (table 1).

We compared our data with data on the donkey strongylid communities from others regions of the world (table 2). The geographical variability in strongylid community structure is apparent.

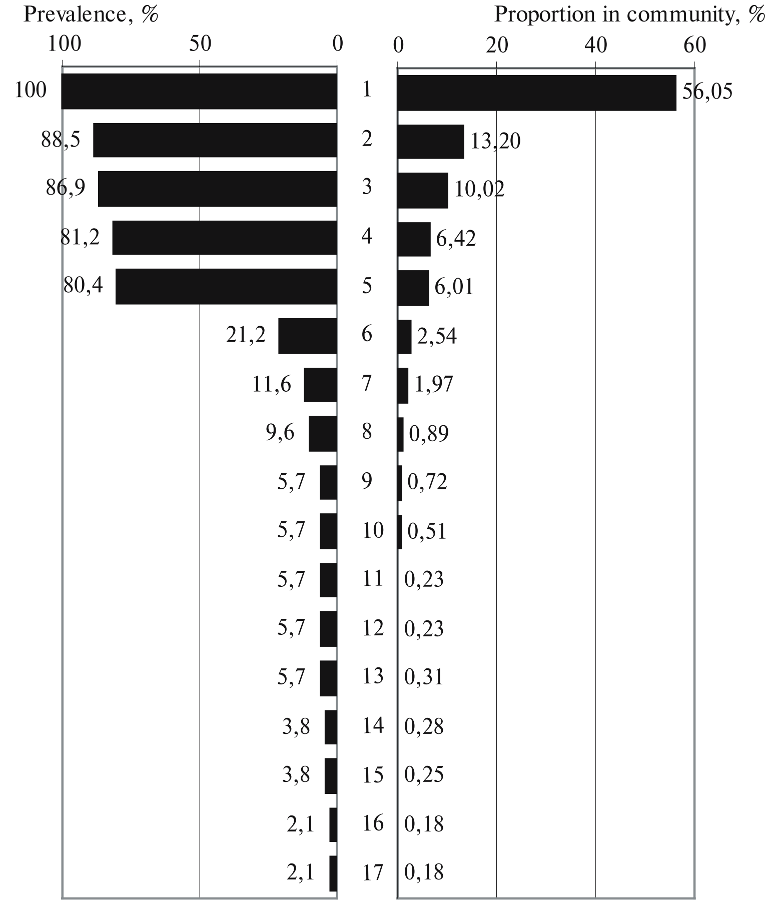


Fig. 1. Prevalence and proportion of various species in the intestinal strongylid community in donkeys examined: 1 — *Cyathostomum tetracantum;* 2 —*Cylicocyclus nassatus*; 3 — *Cyathostomum catinatus*; 4 — *Cylicostephanus longibursatus*; 5 — *Cylicostephanus goldi*; 6 — *Cyathostomum pateratum*; 7 — *Cylicocyclus auriculatus*; 8 — *Coronocyclus coronatus*; 9 — *Cylicocyclus ashworthi*; 10 — *S. edentatus*; 11 — *Cylicostephanus calicatus*; 12 — *Coronocyclus labiatus*; 13 — *Cylicocyclus insigne*; 14 — *Cylicocyclus leptostomus*; 15 — *Cylicostephanus minutus*; 16 — *Cylicocyclus elongates*; 17 — *Coronocyclus labratus.*

Рис. 1. Экстенсивность инвазии и доля различных видов в сообществе стронгилид исследованных ослов.

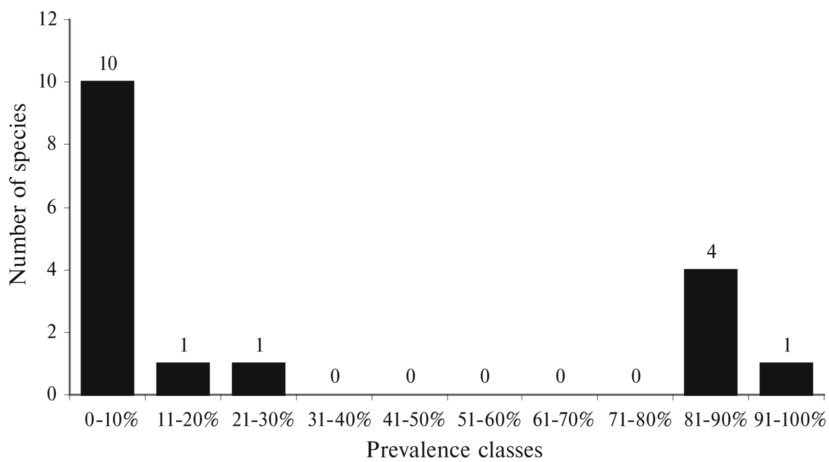


Fig. 2. Number of strongylid nematodes species divided into prevalence classes.

Рис. 2. Распределение количества видов стронгилид по классам экстенсивности инвазии.

Table 1. Number of strongylid species found in donkeys in various regions of the world

Таблица 1. Количество видов стронгилид, обнаруженных у ослов из разных регионов мира

Region	Number of species	% to total number
Ukraine, Present study	17	32
«Askania-Nova» reserve, Ukraine (Kuzmina et al., 2007 a)	23	43
Ethiopia (Kuzmina et al., 2007b)	27	51
Zimbabwe (Eysker, Pandey, 1989)	14	26
South Africa (Matthee et al., 2004)	27	51
Burkina Faso (Vercruysse et al., 1986)	12	23
Kentucky, USA (Tolliver et al., 1985)	28	53
Brazilia (Oliveira et al., 1994)	23	43
Italy (Ricci, Sabatini, 1992)	23	43
Turkey (Burgy et al., 1995)	29	55
Turkmenia (Dobrynin, 1978)	12	23
Uzbekistan (Sultanov et al., 1976)	18	34

Table 2. Analysis of similarity among strongylid communities of experimental donkeys and donkeys from various regions of the world

Таблица 2. Анализ сходства сообществ стронгилид экспериментальных ослов и ослов из разных регионов мира

Region	Chekanovsky-Sórensen Index (IC-S)	Region	Chekanovsky-Sórensen Index (IC-S)
Ethiopia (Kuzmina et al., 2007b)	0.5	Brazilia (Oliveira et al., 1994)	0.75
Zimbabwe (Eysker, Pandey, 1989)	0.39	Italy (Ricci, Sabatini, 1992)	0.7
South Africa (Matthee et al., 2004)	0.73	Turkey (Burgy et al., 1995)	0.7
Burkina Faso (Vercruysse et al., 1986)	0.48	Turkmenia (Dobrynin, 1978)	0.41
Kentucky, USA (Tolliver et al., 1985)	0.71	Uzbekistan (Sultanov et al., 1976)	0.4

Discussion

The results of the present study are the first data on the working donkey strongylid community studied in Ukraine. In contrast to the countries where donkeys are the main working equids in the rural economy and are kept under various management systems (Feseha et al., 2000; Wells et al., 1998), in Ukraine donkeys are kept mainly in zoos and riding schools under "zero-grazing" management system. They are also regularly treated with various anthelmintic drugs. Such management system considerably reduce the gastrointestinal parasite burden in donkeys, that is confirmed by data of this study: the average level of donkey strongylid infection was 75 EPG, while the level of infection was 325 EPG in semi-free living donkeys from the "Askania-Nova" Reserve (Kuzmina et al., 2007 a), or 1440 EPG in working donkeys from Bulgaria(Binev et al., 2005), up to 2204 EPG in South Africa(Wells et al., 1998), up to 1468 EPG in Kenya(Lewa et al., 1999),and even up to 5041 EPG in Ethiopia (Ayele et al., 2006).

Regular anthelmintic treatment also reduces the species richness of the strongylid community in donkeys. Only from 2 to 7 strongylid species were found in one donkey in this study. The number of strongylid species found per donkey from the "Askania-Nova", which were not regularly dewormed, varied from 11 to 15 (Kuzmina et al., 2007 a); 16 to 21 strongylid species were found per working donkey from Ethiopia (Kuzmina et al., 2007 b).

Changes in the strongylid community of regularly dewormed animals are clearly confirmed by the bimodal shape of prevalence frequency distribution of the strongylid species in donkeys examined. The same bimodal shape was registered in regularly dewormed domestic horses from Australia (Bucknell et al., 1995) and in brood horses from Ukraine (Kuzmina et al., 2005). The shape of prevalence frequency distribution of the strongylid species in donkeys, ponies and zebras from Askania-Nova which were

not regularly treated with anthelmintics was multimodal with no core or satellite species (Kuzmina et al., 2007 a).

Donkeys examined harboured specific strongylid species. *Cyathostomum tetracanthum* predominated in the donkey strongylid community; this species was found in 100% of donkeys examined and consisted 56.1% of the total number of strongylids collected. *C. tetracanthum* is known as the dominant species in strongylid communities of donkeys from various regions of the world (Burgu et al., 1995; Daoud, Al-Alousi, 1995; Demir et al., 1995; Matthee et al., 2000; Oliveira et al., 1994; Sultanov et al., 1976; Tolliver et al., 1985). In our opinion, this species infects principally donkeys. In our studies, *C. tetracanthum* was not found in horses, which were kept together with donkeys in riding schools or in ponies and zebras, which grazed the same pastures with donkeys at the "Askania-Nova" Reserve (Kuzmina et al., 2007 a). This species was rarely found in domestic horses, and its relative abundance was only 2.1% (Collobert-Laugier et al., 2002).

The cyathostomin species *Cylicocyclus auriculatus* typical only for donkeys was found in Ukraine. This species was found in donkeys in various regions of the world (Burgu et al., 1995; Eysker, Pandey, 1989; Matthee et al., 2000; Oliveira et al., 1994; Ricci, Sabatini, 1992; Tolliver et al., 1985) and has never been registered in horses.

Strongylid community of donkeys in the present study appeared to be similar to that from "Askania-Nova" Reserve (Ukraine) ($I_{C\text{-}S} = 0.8$), apparently due to geographical and climatic closeness of the latter. Comparatively high similarity was with strongylid communities from Brazil ($I_{C\text{-}S} = 0.75$) and South Africa ($I_{C\text{-}S} = 0.73$), where climatic conditions were similar to those of regions of the present study. The least similarity was registered with strongylid communities from hot and dry regions: Zimbabwe ($I_{C\text{-}S} = 0.39$), Uzbekistan ($I_{C\text{-}S} = 0.4$) and Turkmenia ($I_{C\text{-}S} = 0.41$).

Such strongylid species as *Triodontophorus burchelli*, *T. hartmannae*, *Cylicodontophorus reineckei, Cyathostomum montgomeryi, Cylindropharinx longicauda* and *C. brevicauda* are typical for strongylid communities of African donkeys, were not found in donkeys our study. In our opinion, the cold winter conditions in Ukraine interrupt the development and survival of free-living larvae of these species in the environment. Further studies of the climatic conditions influence on the species composition of strongylid community in donkeys and others *Equus* species are essential.

The results obtained in the present study show that reduction of the species richness of the strongylid community in donkeys from riding schools and zoos was caused by lack of grazing and by regular anthelmintic treatment of donkeys.

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